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(54) **IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR (ICD) SYSTEM HAVING MULTIPLE COMMON POLARITY EXTRAVASCULAR DEFIBRILLATION ELECTRODES**

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(58) **Field of Classification Search**

CPC A61N 1/3918

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,030,509 A 6/1977 Heilman et al.
4,146,037 A 3/1979 Flynn et al.
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1541191 A1 6/2005
WO 2001023035 A1 4/2001
(Continued)

OTHER PUBLICATIONS

Obadia, et al., "New Approach for Implantation of Automatic Defibrillators Using Videothoracoscopy", Journal Ann Cardiol Angeiol (Paris); Sep. 1994; 43 (7) Abstract Only, 1 page.
(Continued)

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(57) **ABSTRACT**

This disclosure provides an extravascular ICD system and method for defibrillating a heart of a patient. The extravascular ICD system includes multiple extravascular electrical stimulation leads or lead segments located in close proximity to one another and having respective defibrillation electrodes. The ICD system utilizes the multiple defibrillation electrodes to form an extravascular electrode vector that may result a reduction in the shock impedance and/or a reduction in the DFT compared to extravascular ICD systems that include only a single extravascular defibrillation electrode. An ICD of the system may, for example, deliver a defibrillation shock using an electrode vector in which a first polarity of the electrode vector is formed by electrically coupling first and second defibrillation electrodes of first and second leads, respectively, to the therapy circuitry and a second polarity of the electrode vector is formed by elec-
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